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*TWELFTH ANNUAL MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA, WASHINGTON, DEC. 27-30TH.*

II.

On reassembling Friday morning the first paper was the following:

STRATIGRAPHY OF THE POTTSVILLE SERIES IN KENTUCKY.

MARIUS R. CAMPBELL, Washington, D. C.

This paper treated of the areal distribution of the conglomerates of the Pottsville series along the western margin of the Appalachian coal field in Kentucky and Tennessee. Three distinct horizons of conglomerates were described which heretofore have been regarded as a single stratum. Attention is called to the unconformity at the base of the series, and the vertical expansion southward was illustrated by numerous sections measured along the margin of the field.

In discussion David White remarked his having mentioned to the Society that the relatively thin cross-section of the carboniferous in this region only represented a part of the thick eastern outcrops. The older eastern Pottsville is lacking. I. C. White remarked the harmony of the results with those attained in Pennsylvania, and that in the late seventies he had realized the complex nature of the Pottsville in Pennsylvania and Ohio. He commented on the thickening to the south. David White also remarked the trough to the south. W. M. Davis asked about the relations of the marine deposits with corresponding fossils, and the fragmental deposits with land plants. J. J. Stevenson remarked the relations of the Devonian and Carboniferous continent to the sea. The Devonian is thin to the south and thick to the north, whereas the Lower Carboniferous is thin on the north and thick to the south.

I. C. White, replying to W. M. Davis, said that the invertebrate fossils were marine and

that the sandstones contained lime. M. R. Campbell said that the materials of the sediments are quartz and that they could not have been derived from lower-lying rocks, which are limestones. The quartz probably came from the Carolina mountains and therefore the water-body was large. Bailey Willis suggested that the Pottsville represented a coastal plain, which was successively transferred, worked over and concentrated.

RELATIVE AGES OF THE KANAWHA AND ALLEGHANY SERIES AS INDICATED BY THE FOSSIL PLANTS.

DAVID WHITE, Washington, D. C.

From an examination of the stratigraphic distribution of the fossil plants of the Kanawha Series in southern West Virginia, it appears that only the upper half of the Series contains the common and characteristic elements of the floras of the Alleghany Series of Northwestern Pennsylvania. The lower half carries a flora which seems distinctly older than any of the floras which occur above the lowest coal of the Alleghany Series.

The plants of the lower Kanawha Series are comparable to those of the Lower Coal Measures of the old World, whereas the plants of the Alleghany Series in Pennsylvania are referable to the Middle and Upper Coal Measures of the European basins.

The discussion of the correlation of the coal floras of the two regions was followed by a brief statement of the stratigraphic changes and conditions of deposition in the Virginian region, as indicated by the distribution of the fossil plants.

I. C. White stated that although the floras changed from Pennsylvania to the Kanawha, the coal seams and sandstones could be traced without a break, from hill to hill. He, therefore, maintained the physical identity of the seams, viz., the Upper Freeport and the Stockton; one of the Kittanings and the Peerless gas coal,

etc. M. R. Campbell remarked the possible diagonalizing of sandstone and shales, and the pinching out of some. J. J. Stevenson corroborated I. C. White's statements to the letter, and insisted that the difference was a botanical and not a stratigraphic one. H. S. Williams supported David White by analogies drawn from the Catskill problem. I. C. White, in reply, again described the continuity of the Upper Freeport with the Stockton. He also stated that the marine forms contradicted the plants; that an abundant marine fauna beneath the Eagle coal corresponded with that of the ferriferous limestone. H. S. Williams and then I. C. White spoke again, but it was evident that there was a deadlock between the paleobotanists and the field geologists. The difference was so pronounced that all the rest of the Society hoped the two Messrs. White would go together over the field from one end to the other and report at a later meeting.

NEWARK FORMATION OF THE POMPERAUG VALLEY, CONNECTICUT.

WILLIAM HERBERT HOBBS, Madison, Wis.

The Newark formation of the Pomperaug Valley rests unconformably upon and is entirely surrounded by Cambrian and pre-Cambrian gneisses. Its sedimentary beds consist mainly of material of other than local derivation, associated with which are sheets of basalt which were once poured out at the surface. Subsequent to their formation the rocks of the area were elevated, tilted to the southeastward at a low angle, and while in this inclined position depressed an amount not less than 2000 feet. This depression of the area was accomplished through an elaborate system of dislocations (gravity faults) involving hundreds of individual fault planes. Of these more than 200 have been mapped.

The fault planes as mapped are quite regularly spaced. The area is thus cut up

into blocks of regular shape, and these blocks are in some cases found to be further subdivided by parallel faults of small displacement until the faulting passes ultimately into prismatic jointing. The directions of the fault planes, which have almost a vertical hade, bear N.  $54\frac{1}{2}^{\circ}$  E., N.  $5\frac{1}{2}^{\circ}$  W., N.  $15^{\circ}$  E., and N.  $34^{\circ}$  W., with less common faults in other directions. Wherever large displacements have resulted from faulting, they are found to be distributed over a number of parallel planes, so as to produce a regular step, or *rampart* structure.

The crystalline gneisses and schists surrounding the basin of the Pomperaug Valley have been deformed by faulting in the same manner as the Newark rocks themselves, thus making it clear that the theory of "lateral compression and differential faulting by accommodation of beds within the gneiss formation" cannot explain the faulting of the Newark formation, as has been claimed.

The peculiar block faulting discovered within the area has brought about a number of topographic forms of relief that have not before been recognized. The drainage of the entire area is found to conform to the deformation, so that both major and minor streams run in courses like eaves-gutters—broken lines with sharp elbows, the elements in the course corresponding in directions with the fault directions named above. The stream channels are generally square in cross section, with a level floor of nearly uniform width, similar to that of an artificial canal. The Pomperaug River, which drains the area, is an illustration of reversal of drainage brought about by the 'discovery' of an upfaulted block of gneiss in its bed. This has resulted in producing a new base level with the formation of a lake above it, which in a later stage has been drained by the pushing back of the divide of one of the principal tributaries, so as to capture the headwaters.

The broad terrane hypothesis regarding the extent of the Newark formation receives material support by this investigation, which shows that an irregular block of the Newark has been depressed below the level of the crystalline gneisses, so as to be by them protected from the abrasion of the ice of the glacial period. The system of faulting within the area furnishes many analogies with the cleavage of a crystal, the explanation of which is doubtless to be found in a probably strained condition of the area, due to the removal of support from below just previous to the time when the dislocations occurred.

The paper was illustrated by lantern slides.

It was followed without discussion by the next title, lunch however, intervening.

#### THE RIVER SYSTEM OF CONNECTICUT.

WILLIAM HERBERT HOBBS, Madison, Wis.

This paper is closely related to the preceding paper. The system of faults there observed was found to have determined the troughs in which flow the streams of the district.

The attempt has now been made to ascertain if the river system of the state indicates, throughout, the existence of similar troughs. A carefully prepared map based upon the recent topographical map of Connecticut by the U. S. Geological Survey, shows that all the master streams, together with their numerous tributaries, flow in troughs which correspond closely in direction with the fault directions of the Pomperaug Valley system, and with two additional closely related directions. The individual troughs can generally be followed into adjacent states, but no attempt has been made to determine their full extent. Some indication of a regularity in the spacing of the parallel troughs is afforded by the map.

The inference from these facts is that the entire area of the state of Connecticut (and

presumably a considerably larger area) has been deformed by faulting in much the same manner as that of the Pomperaug Valley.

The paper was illustrated by a map and by lantern slides.

B. K. Emerson remarked the continuation of these faults to the north into Massachusetts. H. B. Kummel inquired about the fault scarps and whether the cliffs shown in the views were the result of hard and soft beds. The author replied that they were eroded fault scarps. J. F. Kemp remarked the close correspondence of the phenomena in general with others in the Adirondacks and raised the question of the age of the northwest series as shown by the diversion of the Connecticut at Middletown. W. M. Davis discussed the general influence of faults in the early drainage, but thought that they would not be so influential in later time. He also remarked the possible effects of the mantle of Cretaceous strata which may have covered Connecticut. The effect of drift was cited in influencing the course of the rivers. He also felt that the faults were too rectilinear for natural cases. R. D. Salisbury raised the question of the possible connection of the direction of glacial striae with the rivers. Dr. Hobbs replied that there seemed no apparent one. H. W. Turner inquired whether the faults might not be so recent as to have had influence. Dr. Hobbs admitted its probability and cited the reversal of the Pomperaug by a block of gneiss. In general the paper excited the greatest interest, but the feeling seemed to be, that too many and closely related fault systems were carried over the state, and that too great emphasis was not to be placed on the correspondence of the rivers here and there with them.

#### JURASSIC ROCKS OF S. E. WYOMING.

WILBUR C. KNIGHT, Laramie, Wyo.

This paper reviews the early history of the Jurassic investigations in Wyoming

and gave the distribution of both the marine and fresh water beds in that portion lying east of the North Platte river and south of the Fremont and Elkhorn Railroad. Geological sections from several localities were discussed and reference was made to their fossilized remains. The Jurassic were distinguished from the Triassic. The question was raised as to the advisability of retaining the double term Jura-Trias, and its retention was opposed. The age of the fresh water beds was discussed. Some hints were then given as to the grouping of the Rocky Mountain Jurassic beds and the correlation of them with European.

S. F. Emmons remarked the interest of the work and the contrasts afforded by the Wyoming Jurassic with the Colorado beds. H. W. Turner spoke of the desirability of dropping the name Jura-Trias. W. H. Weed mentioned the parallelism with the Yellowstone Park Jurassic. Bailey Willis explained the early use of the term Jura-Trias, as coördinate with carboniferous and cretaceous, and that it would be split up into local names in the inevitable development of field observation.

THE CRETACEOUS AND TERTIARY SECTION BETWEEN CAPE FEAR AND FAYETTEVILLE, N. C.

J. A. HOLMES, Chapel Hill, N. C.

The speaker remarked the importance of the Hatteras uplift, which extends westward through the 'Sand Hill' region. An east and west section was exhibited passing through Wilmington, N. C., and it was shown that there was a great unconformity between the Cretaceous embracing the Eutaw (300') and Ripley (800') and the Tertiary. In the Tertiary very important erosion intervals were also shown at the close of the Eocene and Lafayette.

The paper was discussed by W. B. Clark, who remarked the relations of the strata to

others to the north and especially the absence of the Potomac bed. N. H. Darton made a comparison between the section of the Wilmington well and the Norfolk well. G. B. Shattuck remarked the great oscillations of the Atlantic coast that were indicated by these sections. He cited thirteen known unconformities in the coastal plain. T. W. Stanton described the relations of the fossils brought up by the well-borings, to others from Florida. J. A. Holmes remarked the location of the hinge line of the oscillations and the plans now maturing for their measurement.

MESOZOIC STRATIGRAPHY OF BLACK HILLS OF SOUTH DAKOTA.

N. H. DARTON, Washington, D. C.

The Black Hills uplift brings to view the entire series of Mesozoic formations underlying the plains. These comprise Laramie, Fox Hills, Pierre, Niobrara, Benton, Dakota, Lower Cretaceous, Jurassic and Triassic formations. A detailed investigation has been made by the author of the beds from Jurassic to Pierre, and a large amount of detailed data obtained. Fossils have been discovered in the Jurassic beds comprising fish in the basal members, as announced last year, the southern extension of the marine fauna in the intermediate series and additional Dinosaur remains in the upper beds. The relation of the Dakota to the Lower Cretaceous formations were set forth, and an account was given of many newly-discovered features in the stratigraphy of the Benton and Niobrara deposits. In the Pierre shales there has been discovered a horizon of calcareous lenses of *Lucina occidentalis* giving rise to tepee buttes somewhat similar to those described by Gilbert in southeastern Colorado. There was exhibited a fragment of fossil fish found in the Triassic Red beds.

The paper was followed immediately by the next title.

TERTIARY SHORE LINES AND DEPOSITS IN THE  
BLACK HILLS.

N. H. DARTON, U. S. Geol. Survey.

It has been found that the 'White River' (Oligocene), lake deposits of western South Dakota extend far up the flanks of the Black Hills to shore lines, which are beautifully exhibited in a portion of the region. The relations of these deposits throw important light on the physiographic development of the uplift at several of its stages.

The paper was beautifully illustrated by lantern slides, but as the hour was late and no discussion ensued.

In the evening the Society attended the reception and session of the Washington Academy of Sciences, at which Messrs. Merriam, Gannett, Gilbert and Dall described its general results. A collation followed, which afforded an admirable and welcome opportunity for social intercourse.

The last session of the meeting was called to order at 9:45 A. M., on Saturday, December 30th, and showed a rather slim attendance owing to the departure of many of the members.

The first paper was presented by G. O. Smith and W. C. Mendenhall, and was on the 'Tertiary Granite of the Northern Cascades, Washington.' This granite, which a later petrographical study may show to be a quartz monzonite or quartz diorite, extends over an area of at least 100 square miles. It is intrusive between the Tertiary sedimentaries, as shown by the numerous dikes penetrating the surrounding rocks. The sedimentary rocks are slates, sandstones and conglomerates, and show interesting contact phenomena. Much of the slate is metamorphosed into hornfels, and there is abundant development of such minerals as garnet, epidote and tourmaline along the contacts.

This intrusive mass is important in its relation to the age of the sedimentaries, and

also in its relation to the basaltic flows farther south.

Professor W. M. Davis read the next paper on 'The Basin Deposits of the Rocky Mountain Region.'

The writer questioned the origin of the Tertiary lake beds of the West, and cited examples to prove his theory that many of them are fluvial in origin. The sorting out and distribution of the sediments comprising the strata in these beds indicated stream deposition, and, therefore, basin deposits, rather than lake deposits, is the proper term for these beds. He classed deposits according to three modes of origin—'lacustrine,' 'fluvial' and 'wash,' and argued for the fluvial and occasionally the 'wash' origin of many of the so-called 'Tertiary lake beds' of the Rocky Mountains. His theory was opposed by Messrs. Weed, Emmons, Cross and Russell, all of whom upheld the lacustrine origin of most of these deposits.

Professor A. P. Coleman presented a short paper on 'Heronite and its Related Rocks.'

Professor Coleman exhibited some specimens of this new analcite rock, which occurs as a series of parallel dikes near Heron Bay, Lake Superior. The rock corresponds chemically to nepheline syenite, and he thought perhaps a petrographical study would show the presence of nepheline. The typical rock consists of analcite in which radiating bundles of feldspar and acgirine crystals are imbedded: while a variety occurs with more feldspar in fluidal arrangement, and a second variety where the feldspar is in the form of spheres, sometimes two inches in diameter.

The succeeding paper was by Dr. H. S. Washington on the 'Magnet Cove Laccolith.' Since the excellent work of the late Dr. J. Francis Williams on the Igneous Rocks of Arkansas, much more has become known through the work of Brögger, Lagorio and others about magmatic differentia-

tion, and Dr. Washington's study of the Magnet Cove area leads him to believe that the soda-rich rock species abounding here are simply highly differentiated products of the same continuous flow, and not of three different periods of eruption, as was thought by Dr. Williams. Six analyses were shown which exhibited such a regular variation in the percentages of the various oxides, that the inference was strong towards magmatic differentiation. The central mass is a basic ijolite with low silica 36.51 per cent., and high calcium oxide and the surrounding more or less concentric masses increase their acidity giving, on the outer band a nepheline syenite with silica 53.38 per cent. and large increase in alkalis and low lime. These successive bands show abnormal arrangement.

Plagioclase is absent from the rocks. The abundant garnet is accounted for through the excess of lime, as shown in the analyses.

The time was too short to allow the speaker to dwell much upon the dikes, or upon the reason for calling the mass a laccolite.

The final paper was then presented by August F. Foerste on 'Further Studies on the History of the Cincinnati Anticline.' The theory held by former investigators that the age of this anticline is Lower Silurian and that the Upper Silurian strata were deposited during the gradual subsidence of the central mass, is untenable as shown by measurements of the adjacent strata. According to this theory the upper or last formed deposits would extend farther up the sides of the anticline, whereas careful measurements show that the lowest formations extend the greatest distance up the sides, and Mr. Foerste's theory is that these deposits at one time were continuous across the present anticline and on account of flexure and erosion now occupy the sides, thus indicating an age for the anticline later than the Upper Silurian.

Mr. Campbell agreed with the speaker that there was no evidence of Lower Silurian age for the anticline.

The following papers were then read by title by the President:

RECONNAISSANCE IN SOUTHEASTERN ARIZONA.

E. T. DUMBLE, La Barranca, Mexico.

ON THE AGE AND DISTRIBUTION OF THE SEDIMENTARY ROCKS OF PATAGONIA.

J. B. HATCHER, Princeton, N. J.

CRETACEOUS INVERTEBRATES FROM PATAGONIA

COLLECTED BY J. B. HATCHER.

T. W. STANTON, Washington, D. C.

GEOLOGY OF THE WICHITA MOUNTAINS.

H. FOSTER BAIN, Des Moines, Iowa.

VOLCANICS OF THE NEPONSET VALLEY,  
BOSTON BASIN.

F. BASCOM, Bryn Mawr, Penna.

ENRICHMENT OF MINERAL VEINS BY LATER  
METALLIC SULPHIDES.

WALTER HARVEY WEED, Washington, D. C.

VEIN FORMATION AT BOULDER HOT SPRINGS,  
MONTANA.

WALTER HARVEY WEED, Washington, D. C.

GENESIS OF THE LIMONITE ORES OF PENN-  
SYLVANIA.

T. C. HOPKINS, University of Chicago.

CONTACT METAMORPHISM OF A BASIC IGNEOUS  
ROCK.

U. S. GRANT, Evanston, Ill.

GEOLOGICAL STRUCTURE OF COFFEYVILLE  
(KANSAS) GAS FIELD.

G. PERRY GRIMSLEY, Topeka, Kan.

SURFACE TEMPERATURE OF THE EARTH.

ALFRED C. LANE, Lansing, Mich.

THE GLACIATION OF MOUNT KTAADN, MAINE.

RALPH S. TARR, Ithaca, N. Y.

POST-GLACIAL TIME IN HURON COUNTY,  
MICHIGAN.

ALFRED C. LANE, Lansing, Mich.

KEEWATIN OF EASTERN CENTRAL MINNESOTA.

C. W. HALL, Minneapolis, Minn.

KEWEENAWAN OF EASTERN CENTRAL MINNESOTA.

C. W. HALL, Minneapolis, Minn.

GEOLOGY OF QUEBEC CITY AND ITS ENVIRONS.

HENRY M. AMI, Ottawa, Canada.

GAS-WELL SECTIONS IN THE UPPER MOHAWK VALLEY AND CENTRAL NEW YORK.

CHARLES S. PROSSER, Columbus, Ohio.

VERTEBRATE FOOTPRINTS IN CARBONIFEROUS ROCKS OF WRENTHAM, MASS.

J. B. WOODWORTH, Cambridge, Mass.

About seventy fellows were in attendance and the meeting was a large and in every way an enjoyable one. The Fellows resident in Washington spared neither effort nor expense in entertaining the visitors, and the vote of thanks passed at the final session was a very sincere expression of a deeply felt sentiment.

In the above report the notes for the first three days were prepared by J. F. Kemp, those for the last day by A. S. Eakle.

J. F. KEMP.

COLUMBIA UNIVERSITY.

A. S. EAKLE.

HARVARD UNIVERSITY.

#### SCIENTIFIC BOOKS.

*Electro-physiology.* By W. BIEDERMANN. Professor of Physiology in Jena. Translated by FRANCES A. WELBY. Macmillan & Co. Vol. II., pp. 500.

Miss Welby's translation of the first volume of this well-known work was reviewed some time ago in these columns. It treated of the structure, contraction, and electrical stimulation of muscle, and of the electromotive phenomena of muscle, epithelium and glandular tissue. The second volume, comprising the structure, conductivity, excitability and electrical stimulation of nerve and the electromotive phenomena of nerve, electrical organ and vegetable cells, has now appeared.

When a physiologist of Professor Biedermann's eminence sums up the results of that department of the science which he has so brilliantly illustrated by the labors of a lifetime, and, knowing well how comparatively narrow will be the circle of his readers, lays his contribution at the feet of his fellow-workers, it may seem ungracious to criticise the gift. Yet we are bound to say, if criticism is not to abdicate its function, that praise must be tempered with censure in passing judgment on this book. That it is full of interesting and important observations, it is unnecessary to say. Even if the author had contented himself with an account of his own experiments this could not fail to be the case. But the treatment of the subject is not always so clear as might have been expected from so great a master. Unnecessary difficulties are placed in the way of the reader by the intricacies of a somewhat diffuse and ponderous style. The lack of proportion and perspective is conspicuous. The author, while doubtless himself well able to discriminate between the importance of weighty generalizations and that of petty experimental details, apparently makes little effort to help his reader to do so, and the student sometimes rises from the perusal with the feeling that he cannot see the wood for the trees.

The author naively admits, in the preface to his first volume, that he has not attempted to avoid partisanship in the treatment of certain topics which have given rise to the liveliest discussion and have separated electro-physiologists into warring camps. He has preferred, as he says, to present these thorny problems from the point of view of his master Hering, which happens also to be his own. The candor of this avowal almost disarms criticism. Yet we must say that although in a sketch such an attitude might be entirely excusable and even praiseworthy, it is to be doubted whether in a professedly exhaustive treatise like the present it is well to skate so lightly over the thin ice of controversy. For it is often impossible to thoroughly understand a question without a knowledge of the history of the disputes that have arisen in regard to it.

Like most of his countrymen, the author scarcely does justice to foreign and especially to